radiation is emitted in the form of infrared.

In particular for a grey body at a temperature of 2800K, slightly less than 10% of radiation is emitted in the visible spectrum (380-780 nm), whilst over 20% is emitted in near infrared (780-1100 nm).

In fact, the tungsten filament is not an actual grey body, but it has a spectral emissivity that is more or less constant in the visible spectrum, and tends significantly to decrease in near infrared, as is readily apparent from the reflectance and spectral emissivity curves shown in Figure 1. In the graph of Figure 1, the curves CRW and CEW respectively represent the reflectance and the emissivity of tungsten at ambient temperature for different wavelengths in the visible and near infrared spectrum.

This causes the efficiency of a tungsten filament, i.e. the ratio between visible radiation and total emitted radiation, is far greater than that of a grey body; the advantage is still more significant when considering the spectral emissivity at ambient temperature. Figure 2 compares the Planck's curve at 2800K, designated CP, with the spectral power emitted by a tungsten filament at 2800K; for tungsten, the chart shows both the experimentally measured values (curve PM), and the values calculated using the optical constants of tungsten at ambient temperature (curve PC).

<u>Summary of the invention</u>

Based on the above, the present invention aims to provide an emitter for incandescent sources, capable of being brought to incandescence by a passage of electric current, having a higher efficiency than filaments for incandescent lamps obtained with traditional techniques.

The term "efficiency of the light source" means the

CLAIMS

1. An emitter for incandescent light sources, capable of being brought to incandescence by means of the passage of electric current, characterised in that

- on at least one surface of the emitter (F) is provided a micro-structure (R) operative to enhance absorbance for wavelengths belonging to the visible region of the spectrum,

- at least a substantial portion of the emitter (F), including said micro-structure (R), is coated with a refractory oxide (OR) or an oxide with high melting point.

2. An emitter as claimed in claim 1, characterised in that said refractory oxide (OR) is operative to preserve the profile of said microstructure (R)

- from effects of evaporation of the respective material (W; Au; W, Au) at high operating temperature, and/or

- in case of deformation or change of state of the respective material (W; Au; W, Au), consequent to the use of the emitter (F) at operating temperatures exceeding the melting temperature of said material (W; Au; W, Au).

3. An emitter as claimed in claim 2, characterised in that the emitter (F) is almost completely coated by said refractory oxide (OR), in particular with the exception of respective areas for connection to terminals (H).

4. An emitter as claimed in claim 2, characterised in that said micro-structure (R) is made of a conductor, semiconductor or composite material (W; Au; W; Au), whose optical constants, combined with the shape of the micro-structure (R), are such as to allow a higher luminous emission efficiency than a classic incandescence filament, said efficiency being defined

as the ratio between the fraction or visible radiation emitted at the operating temperature in the interval 380 nm - 780 nm and the fraction of radiation emitted at the same temperature in the interval 380 nm - 2300 nm.

5. An emitter as claimed in claim 2, characterised in that said material (Au) is selected among conductor, semiconductor and composite materials whose melting point is lower than the operating temperature of the filament itself.

6. An emitter as claimed in claim 2, characterised in that it is formed by at least a first layer of conductor material (W), melting at higher temperature than the operating temperature of the emitter (F), such as tungsten, and by a second layer of material (Au) selected among conductor, semiconductor and composite materials whose melting point is lower than the operating temperature of the emitter (F).

7. Emitter as claimed in any of the previous claims, characterised in that said micro-structure (R) is at least partly formed with a material selected among gold, silver and copper.

8. Emitter as claimed in any of the previous claims, characterised in that said refractory oxide (OR) is selected among ceramic base oxides, thorium, cerium, yttrium, aluminium or zirconium oxide.

9. An emitter as claimed in claim 1, characterised in that said micro-structure (R) is obtained by means of a superficial micro-structure of the emitter (F), i.e. in the same material which constitutes the emitter (F).

10. An emitter as claimed in claim 1, characterised in that said micro-structure comprises a diffraction grating (R), having at least one between a plurality of micro-projections (R1, R2) and a plurality of micro-

cavities (C), where the dimensions (h, D) of the micro-projections (R1, R2) or of the micro-cavities (C) and the period (P) of the grating (R) are such as to

- enhance the emission of visible electromagnetic radiation from the material (W; Au; W, Au) constituting at least the micro-structure (R), and/or

- reduce the emission of infrared electromagnetic radiation from the material (W; Au; W, Au) constituting at least the micro-structure (R), and/or

- enhance the emission of the infrared electromagnetic radiation from the material (W; Au; W, Au) constituting at least the micro-structure to a lesser extent with respect to the increase in visible emissivity.

11. An emitter as claimed in claim 10, characterised in that said grating (R) is obtained with

- a first conductor material (W) melting at higher temperature than the operating temperature of the emitter (F), the first material having a structured part,

- a coating layer (Au) which covers at least the structured part of said first material (W), the coating layer being of a second material (Au) selected among conductor, semiconductor or composite materials melting at lower temperature than the operating temperature of the emitter (F),

where the coating layer (Au) is sufficiently thin to copy the profile of the structured part of the first material (W), to form therewith said grating (R), and the second material (Au) has a greater emission efficiency than the first material (W), said efficiency being defined as the ratio between the fraction of visible radiation emitted at the operating temperature in the interval 380 nm - 780 nm and the fraction of radiation emitted at the same temperature in the

interval 780 nm - 2300 nm.

12. An emitter as claimed in claim 10, characterised in that

- said grating (R) is obtained on the surface of a layer (Au) of a first conductor, semiconductor or composite material whose melting point is lower than the operating temperature of the filament (F),

- said layer (Au) is placed on a second conductor material (W) whose melting point is higher than the operating temperature of the emitter (F),

where the first material (Au) has higher emission efficiency than the second material (W), said efficiency being defined as the ratio between the fraction of visible radiation emitted at the operating temperature in the interval 380 nm - 780 nm and the fraction of radiation emitted at the same temperature in the interval 380 nm - 2300 nm.

13. An emitter as claimed in claim 10, characterised in that said grating (R) is obtained with

- a layer of refractory oxide (OR) having a structure part,

- a coating layer (Au) which covers at least the structured part of the layer of refractory oxide (OR), the coating layer being of a material (Au) selected among conductor, semiconductor or composite materials melting at lower temperature than the operating temperature of the emitter (F),

where the coating layer (Au) is sufficiently thin to copy the profile of the structured part of the first material (W), to form therewith said grating (R), and where the coating layer (Au) is in turn coated by an encapsulating layer constituted by refractory oxide (OR).

14. An emitter as claimed in claim 3, characterised in that at least a throat or cavity (G) is provided,

open on the material constituting the emitter (F) and defined in at least one among said electrodes (H) and said refractory oxide (OR), the cavity or cavities (F) provided being operative to receive part of said material as a result of volume expansions thereof and/or to avoid delamination phenomena between said refractory oxide (OR) and said material and/or ruptures of the complex constituted by said material, said refractory oxide (OR) and said electrodes (H).

15. An emitter as claimed in claim 10, characterised in that the periodicity of the micro-projections (R1, R2) or of the micro-cavities (C) is of the order of the wavelength of visible radiation.

16. An emitter as claimed in claim 10, characterised in that the periodicity of the micro-projections (R1, R2) or of the micro-cavities (C) is between 0.2 and 1 micron.

17. An emitter as claimed in claim 10, characterised in that the height or depth of the micro-projections (R1, R2) or of the micro-cavities (C) is between 0.2 and 1 micron.

18. An emitter as claimed in claim 1, characterised in that said anti-reflection micro-structure (R) is binary, i.e. with two levels.

19. An emitter as claimed in claim 1, characterised in that said anti-reflection micro-structure (R) is multi-level, i.e. it has a projection with more than two levels.

20. An emitter as claimed in claim 1, characterised in that said anti-reflection micro-structure (R) has a continuous projection.

21. An emitter as claimed in any of the previous claims, characterised in that it operates at a lower temperature than the melting point of the refractory oxide (OR)..

22. An emitter as claimed in any of the previous claims, characterised in that it is configured as a filament or planar plate structured under the wavelength of visible light, and in that said anti-reflection micro-structure (R) is a two-dimensional grating of absorbing material (k>1).

23. A method for constructing an emitter capable of being brought to incandescence by the passage of electric current, comprising the steps of:

a) constructing a template of porous alumina,

b) infiltrating the template of porous alumina with a material destined to constitute the emitter (F), in such a way that the alumina structure serves as a mould for at least part of an anti-reflection micro-structure (R) of the emitter (F),

c) and possibly

c1) subsequently eliminating the alumina structure, or

c2) maintaining the alumina structure on the anti-reflection micro-structure (R) and depositing a refractory oxide (CR) onto the remaining part of the emitter (F) destined to extend between two respective terminals (H).

24. A method as claimed in claim 23, where the step a) comprises the deposition of an aluminium film, with thickness in the order of one micron, on a suitable substrate and the subsequent anodisation thereof, said anodisation comprising at least:

- a first phase of anodisation of the alumina film;
- a phase of reducing the irregular alumina film obtained as a result of the first anodisation phase;
- a second phase of anodisation of the alumina film starting from the residual part of irregular alumina not eliminated by said reduction phase.

25. A method for constructing an emitter capable of

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being brought to incandescence by the passage of electric current, comprising the steps of:

- obtaining a filiform or laminar element of the material whereof the emitter is to be made (F);
- etching said element to form an anti-reflection micro-structure (R),

and possibly coating the emitter (F) in which the anti-reflection micro-structure (R) has been formed with a refractory oxide (OR).

26. An incandescent light source, comprising a light emitter capable of being brought to incandescence by the passage of electric current, characterised in that said emitter (F) is as claimed in one or more of the claims from 1 through 22.

27. A lighting device, in particular for motor vehicles, comprising one or more light sources (1) as claimed in claim 26.

28. A planar matrix of micro-sources of incandescent light, each comprising a respective emitter (F) as claimed in one or more of the claims 1 through 22.